Water

P.E.I.'s MOST PRECIOUS RESOURCE

MURRAY RIVER

WATERSHED ACTIVITIES

SURFACE WATER PROGRAM

MARCH 1990

THE CANADA—PRINCE EDWARD ISLAND
WATER MANAGEMENT AGREEMENT

Environment Canada Environnement Canada

Prince Edward Island
Department of the Environment

MURRAY RIVER

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Prepared by:

Environment Canada
Inland Waters Directorate
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P.E.I. Department of the Environment
Fish and Wildlife Branch

SURFACE WATER PROGRAM

MARCH 1990

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PREFACE

This report is one of a series produced as a result of the Canada - Prince Edward Island Water Management Agreement. The work was performed as part of the Watershed Inventory Project under the Surface Water Program.

It was initiated in order to gain a better understanding of the activities which may impact on the quality and quantity of surface waters drained by the Murray River.

The report is intended to be used in conjunction with the report entitled "Activities Affecting Surface Water Resources - A General Overview" and the book of "Murray River Watershed Inventory Maps" which is maintained on file at Inland Waters Directorate, Environment Canada in Dartmouth, Nova Scotia. All references to maps in this report are to the atlas.

Mapping was performed on the 1:50,000 N.T.S. topographical series using the Universal Transverse Mercator (U.T.M.) grid system to the nearest one hundred (100) metres for point data. Non-point (polygon) data is also mapped where applicable. This mapping technique is easily transferable to the Geographical Information System (G.I.S.) which provides for updating and manipulation of the data.

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1.0 INTRODUCTION

In November 1987, the Canada - Prince Edward Island Water Management Agreement was signed. The Agreement focuses upon several areas including groundwater contamination, surface water degradation and estuarine eutrophication. Of these, the Watershed Inventory Project, as part of the Surface Water Program, has been designed to identify current and future users of surface water and to document resource conflicts within twelve watersheds across the province. The Murray River Watershed (Figure 1.1) was identified as an area of study for the project.

2.0 GENERAL CHARACTERISTICS OF THE MURRAY RIVER WATERSHED

2.1 Physiography

The several glaciers which at one time covered Prince Edward Island have caused a gently undulating terrain across much of the province. The Murray River Watershed, which is located in the southeastern part of Kings County, encompasses a gently rolling section of the province. The maximum elevations of about seventy-seven (77) metres occur in the northeastern section of the watershed. The remainder reaches maximum elevations of about forty (40) metres although the western sections are much flatter.

The watershed drains a land base of approximately seventy-five square kilometres (73.49 km^2) through seventy-two kilometres (72 km) of the Murray River and its tributaries. The tributaries (Mink River, Greek River, Fox River and several unnamed) enter the Murray River at various points along her length. The Murray River then flows into Murray Harbour before emptying into the Northumberland Strait.

A physiographic comparison with Prince Edward Island (Figure 2.1) reveals that the watershed is more forested than the Island on average (Taylor, 1988). Only twenty-five percent (25%) of the watershed is cleared.

The Murray River Watershed is sparsely populated with the major municipality of Murray River located on the shores of the River near MacLures Pond. There are houses and farms scattered throughout the remainder of the area. As is the case with the Island as a whole, the watershed is traversed by several roads including many which are not plowed during the winter.

2.2 Soils

Prince Edward Island's podzol soils, formed mainly from the weathering of sandstone, are generally stone-free, sandy

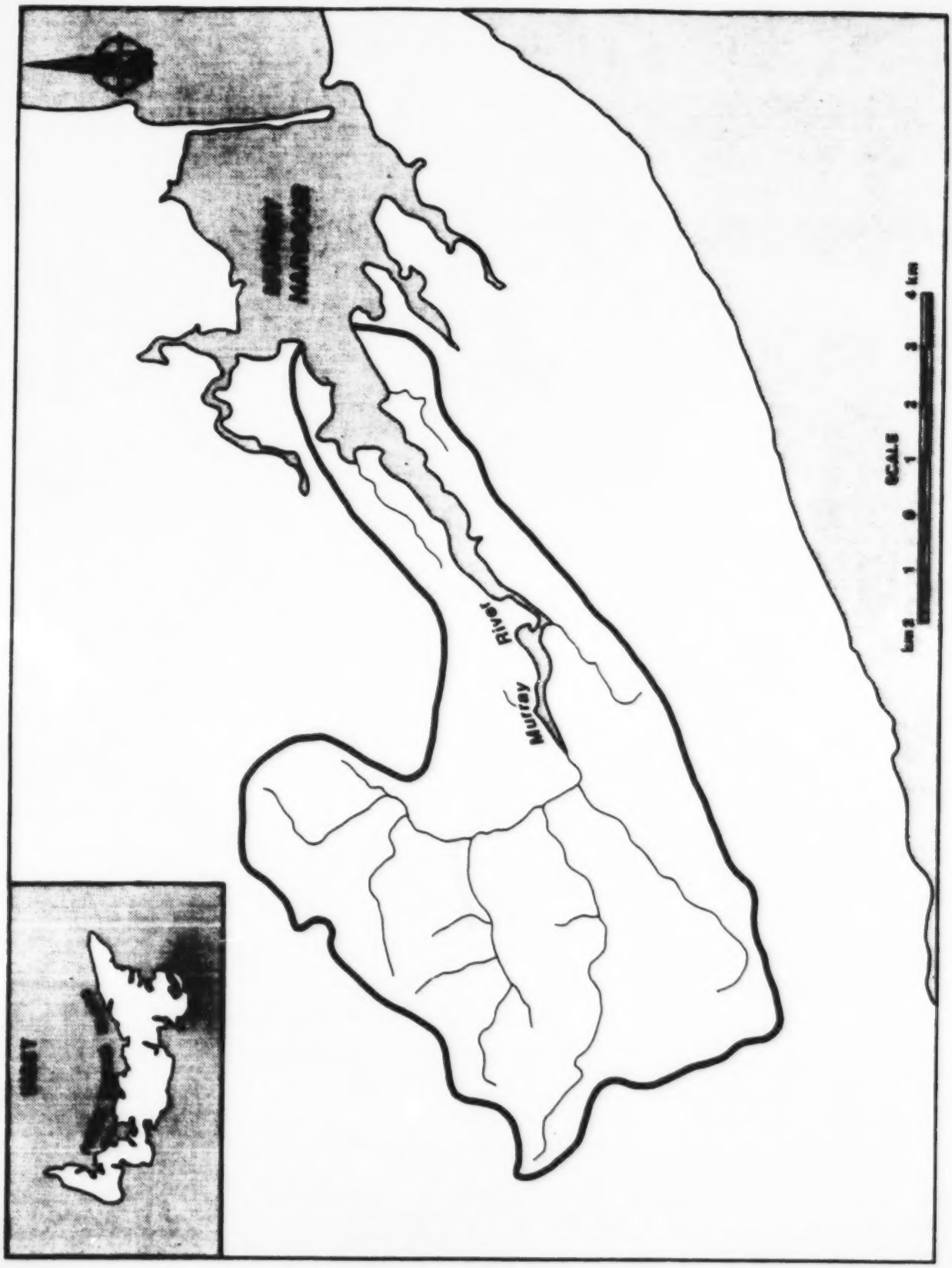
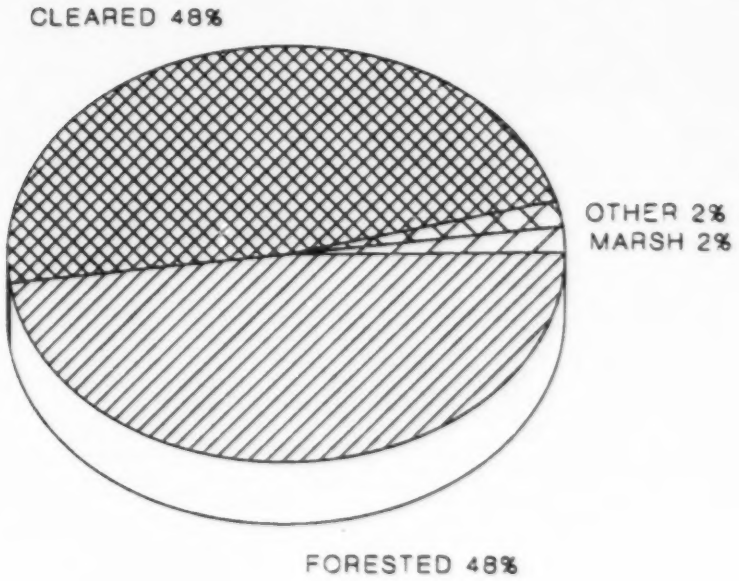


Figure 1.1 Murray River Watershed

PRINCE EDWARD ISLAND



MURRAY RIVER WATERSHED

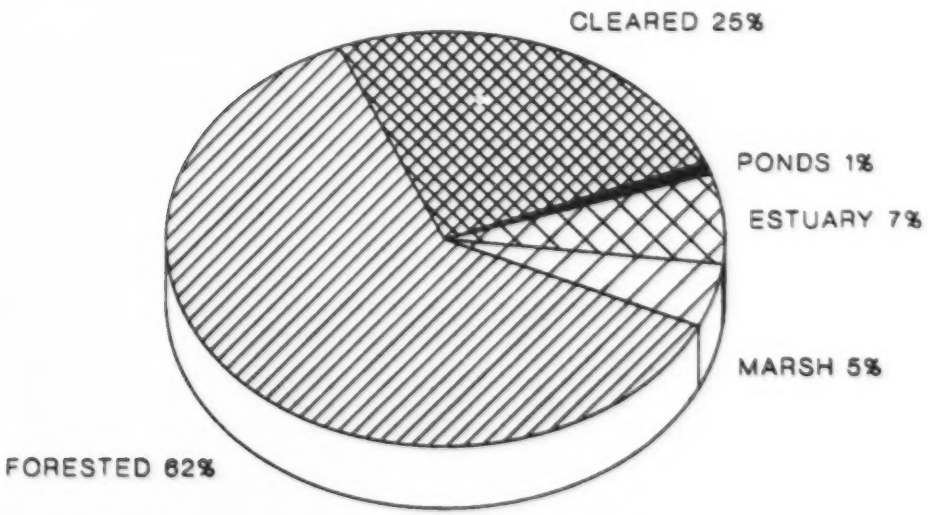


Figure 2.1 Physiographic Comparison Between Prince Edward Island and the Murray River Watershed.

and permeable. The Murray River Watershed is composed of varying amounts of Class 0, 2S, 3S, 4S, 4T, 4^{*}_{w}, 5^{*}_{w}, 5W, 7I, 7W and 7^{*}_{w} soils. Approximately five percent (5%) of the soils are Class 0, fifteen percent (15%) Class 2, fifty percent (50%) Class 3, twenty percent (20%) Class 4, five percent (5%) Class 5 and fifteen percent (15%) are characterized as Class 7 (Canada Land Inventory, 1968).

3.0 AGRICULTURAL OPERATIONS

Despite the fact that agriculture forms a major part of Prince Edward Island's economy the Murray River Watershed's soils are generally not well-suited for crop production. Agricultural activity is limited to a few livestock operations (Map 11L/2) and the production of potatoes, tobacco, oats, barley and hay.

3.1 Dairy Operations

There are two dairy operations within the Murray River Watershed (Figure 3.1) containing thirty (30) or more head (30 milkers and 30 feeders) of cattle (Younie, 1989).

3.2 Beef Operations

There are three beef cattle operations (Figure 3.1) with fifty (50) or more head (50 cattle plus 50 feeders) present. Each of these operations contains at least seventy-five (75) head of cattle. One is a feedlot operation located in Hopefield. There is an additional beef operation, containing thirty (30) head of cattle and twenty (20) horses, which is located in Alliston (Younie, 1989).

3.3 Hog Operations

Nine hog operations are located within the watershed (Figure 3.1). Each has an annual production of eight hundred (800) or more (Younie, 1989).

3.4 Poultry Operations

There is one poultry operation of significant size (Figure 3.1) within the watershed. It is located at Glenwilliam (Younie, 1989).

3.5 Fox Operations

Two fox ranches (Figure 3.1) of noteable size are located in the watershed (Younie, 1989).

3.6 Stock Watering

Most livestock on Prince Edward Island are watered from groundwater after it has been piped into a trough (Murphy,

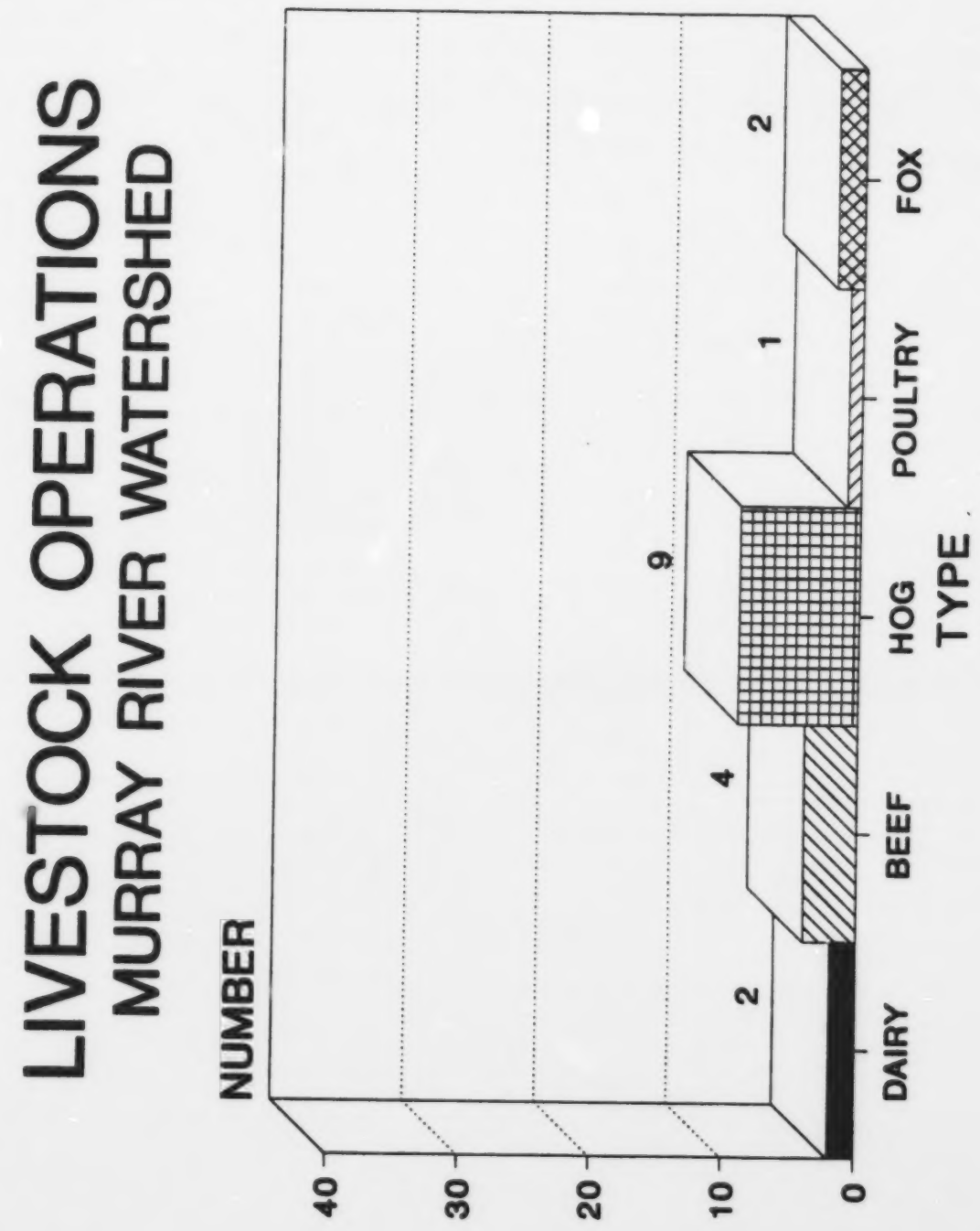


Figure 3.1 Livestock Operations Located Within the Murray River Watershed

S., 1988). However, there have been instances noted across P.E.I., including the Murray River Watershed, in which animals were observed drinking from streams traversing pastures. This results in destabilization of the stream banks, siltation and bacterial contamination of the water.

3.7 Irrigation

The Prince Edward Island Department of Agriculture does not keep specific records on irrigation occurring within the province. Water used for irrigation generally comes from a surface water source such as a farm pond or stream. During unusally dry years, there are probably more farmers than usual who have to irrigate (Clough, 1988). This activity may have an effect on the amount of water available for users downstream of the withdrawal location. Therefore, a system should be set up tp monitor the extent of water withdrawal.

3.8 Dead Stock Burial

There are no dead stock burial sites located within the watershed. Farmers can pay a service fee to have their stock discarded at an approved disposal site or they can sell their dead animals to Maritime Pet Foods. Both are located outside of the watershed. They can also dispose of the animals on their own land (which is the most likely scenario).

4.0 FISH AND WILDLIFE RESOURCES

Fish and wildlife resources are important to both residents and tourists alike on Prince Edward Island in terms of the recreational and economic benefits they provide. Fish and wildlife on P.E.I. are dependent upon surface water resources either for primary habitat or as a source of drinking water.

4.1 Angling Areas

There are numerous angling sites located along the river banks within the Murray River Watershed (Map 11L/2) including two listed in Angling on Prince Edward Island (P.E.I. Department of Tourism and Parks, 1988). The most frequented locations have been delineated by the P.E.I. Fish and Wildlife Conservation Officer responsible for the area (Stewart, 1989).

4.2 Hunting Areas

Waterfowl hunting areas are limited to those locales near the rivers (Stewart, 1988). The limited inland wetlands reduce the number of waterfowl to the area during migration periods. Goldeneyes and mergansers are known to overwinter at MacLures Pond. Upland game is more common as the extensive wooded areas provide habitat for snowshoe hare and

ruffed grouse. Other game hunted within the watershed include Hungarian partridge, snipe and woodcock. Since wildlife is known to be migratory, in response to habitat requirements and food availability, their boundaries are not static from year-to-year.

4.3 Trapping Areas

As with hunting areas, the trapping areas within the watershed (Map 11L/2) do not have consistent boundaries from year-to-year. They are dependent both upon the movement of animals and the preferences of trappers. Species trapped include some beaver, muskrat, fox, mink and raccoon (Stewart, 1989). Trapping activity varies from year-to-year depending on the price of the furs.

4.4 Beaver Activity Areas

Beaver-built dams result in the creation of flowages which can supply additional habitat for additional wildlife such as waterfowl, mink and muskrat but can also affect the quality of habitat for other species (pheasants, grouse and snowshoe hare) and the ability of finfish species to pass through the site on their way to upstream or downstream areas. Very little beaver activity is occurring in the river (Map 11L/2), (Dibblee, 1989).

5.0 RECREATIONAL ACTIVITIES

Surface water and some recreational activities go hand-in-hand (swimming and boating). Other activities (hiking and skiing) are often enjoyed in close proximity to streams and rivers. Similarly, major recreational facilities (provincial parks and campgrounds) are generally situated adjacent to Island surface water resources.

5.1 Provincial Parks / Private Campgrounds

There is one provincial park within the Murray River Watershed. Fantasyland Provincial Park, a twenty (20) hectare (50 acre) day-use park located near Gladstone (Map 11L/2), offers family-type activities. Most of the Park contains wooden playground equipment and large concrete "fairytale" characters for children. There is also a picnic area and a comfort station containing flush toilets. The park allows for swimming at its limited shorefront on the Murray River (Mills, 1989).

Two private camping areas are found within the watershed's boundaries. Seal Cove Campground and Golf Course, located near the Mink River and Indian Creek (Map 11L/2), has seventy-seven (77) camping sites. There are flush toilets, showers and a dumping station in the Campground. A swimming pool is located on-site but swimmers

also have access to the beach.

Gladstone Tent and Trailer Park, located on the banks of the Murray River near Gladstone (Map 11L/2), contains twenty-four (24) sites, flush toilets, showers and a dumping station.

There are also two summer camps in the watershed. The Atlantic Pioneer Camp, which is located at McInnis Point (Map 11L/2) and is sponored by a Christian group, contains a main lodge and seven cabins, as well as, sites for trailers and tents. The trailer sites do not have hook-ups for sewage. The main lodge contains flush toilets, showers and kitchen facilities. There is a septic field used for the treatment of wastes. Activities at the Camp include swimming, sailing, windsurfing and canoeing (Walker, 1989).

Fair Haven Girl Guide Camp, which is located in Point Pleasant (Map 11L/2), operates from June to October each year. During the busiest periods (late June to mid-August) the Camp caters to about one hundred (100) people per week. There is a main lodge, bunkhouse and three large tent sites on the property. The flush toilets and showers are directed to one of two septic tanks for later removal. Pits are dug at the tent sites for the disposal of dishwater. Garbage is stored in a shed for later removal to an approved active dump site. Water-related activities at the Camp include swimming, canoeing and and boating (Fraser, 1989).

Nine additional accommodation's (bed and breakfast and motel) facilities are available within the watershed with several offering swimming, boating, fishing and hiking activities.

5.2 Swimming Areas

Generally people will swim where they desire. On P.E.I., many of the best swimming areas are coastal. Several of the favored swimming locations within the watershed have been mentioned previously (refer to section 5.1). Swimming also occurs at MacLures Pond, Finlaysons Pond and in the larger rivers near the bridges (Map 11L/2).

The only organized swimming activities on the Island occur through the Canadian Red Cross Society which does not conduct swimming events within the Murray River Watershed (MacLean, 1989).

5.3 Boating / Canoeing Areas

The Murray River is good for boating and canoeing with several launching sites located throughout the watershed. Most power boats enter the River from public launching ramps located at the fishing wharf in the Village of Murray River. There are two additional sites which provide access to Big

Basin, a tributary located near the mouth of the Murray River (Map 11L/2).

The Prince Edward Island Recreational Canoeing Association is able to provide additional information on various canoeing routes throughout the province but does not offer any organized trips. The Murray River is suitable for canoeing the southwest corner of MacLures Pond to the wharf on the Greek River (Map 11L/2), (P.E.I. Department of Tourism and Parks, n.d.).

Boardsailing is gaining popularity on P.E.I. The large estuarial section of the Murray River which opens to Murray Harbour and the prevalence of wind makes the area ideal for windsurfing.

5.4 Hiking / Cross-Country Skiing / Snowshoeing

For the nature-buff or recreational enthusiast a good method in which to see an area is on foot either by hiking, cross-country skiing or snowshoeing. In this way, people can go at their own pace, perhaps photographing what catches their eye or just enjoying the great outdoors.

There is one nature trail located within the Murray River Watershed. It is located within the Murray River Pines Natural Area (see Section 10.2). An additional trail is located just outside of the watershed near Murray Harbour. This cottage development has a nature trail traversing through eight hectares of mixed woods. Unpaved roads and the soon to be abandoned rail lines also provide for good hiking trails. These trails can also be used for recreational activities such as cross-country skiing and snowshoeing.

5.5 Snowmobiling / Horseback Riding

There are no snowmobiling clubs located within the watershed and therefore no large organized excursions. Snowmobilers are often observed riding through fields and along woods' and seasonal roads.

There are not any commercial horseback riding operations located within the Murray River Watershed. However, there have been horses noted in pastures. It has been assumed that horseback riding does occur on a limited scale.

5.6 Unplowed (Seasonal / Scenic Heritage) Roads

Many local and unpaved roads in the watershed (Map 11L/2) are not kept open for vehicular traffic during the winter months. The relative abundance of such roads provides excellent facilities for winter recreational activities such as cross-country skiing, snowshoeing and snowmobiling. Often not well travelled even during the warmer months, these roads may further supply recreational opportunities for hiking,

cycling and horseback riding.

Some roads across the Island have been designated as Scenic Heritage Roads as a result of their natural and historical significance. There have not been any roads so designated within the Murray River Watershed (Horne et. al., 1988).

6.0 FISHERIES OPERATIONS

The fishing industry is very important to the economy of Prince Edward Island. All of the major Island watersheds have an estuarial component thereby supporting a fishery to some extent. Finfish and shellfish harvesting conducted within the Murray River Watershed (Map 11L/2) can be placed into three broad categories, namely; licensed commercial, non-licensed commercial / recreational and finfish aquaculture.

6.1 Licensed Commercial

Some sections of the Murray River estuary are classed as public fishing domain. As such, there are no suspended or ground shellfish leases and any fisherman can remove shellfish in season. Other areas are specific leased areas or zones and can be fished only by the lease owner. There are twenty-two (22) mussel leases and three oyster leases located within the watershed (Map 11L/2), (Small, 1989).

The primary public oyster harvesting areas in the watershed are indicated in Map 11L/2. Quahogs and soft-shelled clams are also harvested just outside of the watershed on both a commercial and non-commercial basis.

It is open to eel netting annually from August 15 to November 30. The entire system is open to eel spearing on a year round basis. Box nets are used to trap smelt during the annual season (October to February). Smelt catches are regulated by season and are monitored by Department of Fisheries and Oceans personnel. Since the seal hunt has been scaled down concern has been expressed about the negative impact of seals feeding on smelts as they migrate into the watershed.

The value of the fish and shellfish landed within the watershed are shown in Figure 6.1. Shellfish concentrations in the estuary have been identified by Department of Fisheries and Oceans staff (Map 11L/2).

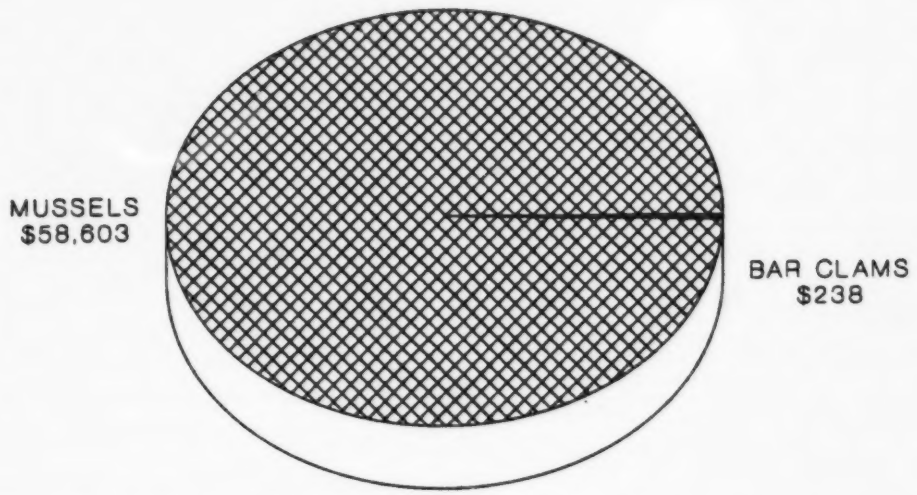


Figure 6.1 1987 Fish/Shellfish Landings Within the Murray River Watershed

6.2 Non-Licensed Commercial / Recreational

Trout and smelt are harvested in season for personal consumption and some mackerel are taken at the mouth of the Murray River. Quahogs, clams and mussels are also harvested from public areas.

The River is closed to shellfish harvesting upstream from Buxtons Point and Cuddys Point (Map 11L/2) due to bacterial contamination. Most clams are harvested in the area east of French Marsh Point which is located just outside of the watershed's boundary.

6.3 Finfish Aquaculture

The watershed contains one finfish aquaculture operation. It is a land-based operation located near Dover at Upper MacLures Pond. In 1989, its start-up year, the operation contained 50,000 rainbow trout and 10,000 Atlantic Salmon fry. Water is sourced from wells and Upper MacLures Pond at rates of 500 and 800 gallons per minute, respectively. A settling pond is located on-site which treats the fish wastes thereby reducing both the risk of contamination of the surface water and disease to the trout and salmon (Murphy, L., 1989).

7.0 INDUSTRIAL OPERATIONS

Many of the industrial operations located on Prince Edward Island have an effect on surface water resources in one way or another. Some discharge both treated and untreated wastes directly into streams and rivers, while others unknowingly allow for the seepage of pollutants to surface or ground water sources. Some industrial operations require a surface water source for use in their processes.

7.1 Stormwater Drainage

There are several stormwater drainage inlets within the Village of Murray River. There are also several corrugated steel sand traps which help remove any garbage in the water before it is released directly into the Murray River (MacLure, 1989). No plans or figures are available regarding the number and location of collection inlets in the Village or the number or location of outlets to the River (MacKay, 1989).

7.2 Sewage Treatment Plants / Lagoons

There are not any sewage treatment plants or lagoons located within the watershed. Sewage is either treated by individually installed septic systems or is discharged directly into the Murray River (White, 1989).

7.3 Abandoned, Active and Unapproved Dump Sites

During 1982-83, the P.E.I. Department of Community and Cultural Affairs, in conjunction with Environment Canada performed a study in which abandoned, active and unapproved waste disposal sites on Prince Edward Island were located and inspected (Water Resources Section, 1983). Of prime concern during the Inventory was the potential for groundwater contamination. There were a total of three sites identified within the Murray River Watershed (Map 11L/2).

As part of the Inventory, a scoring system was used to rate and priorize (Priority I, II and III) each site on the basis of actual and potential environmental effects. Priority I sites were rated as being most hazardous to the environment; Priority II dumps were less hazardous; while Priority III sites were generally very small discriminate sites which were not considered to be environmentally hazardous. Evaluation of the area revealed one Priority I site at Wilmot, one Priority II site at Cambridge and one Priority III site at Alliston. Two of the sites are approved active (operated by the province) while the site at Alliston is an unapproved site (Curley, 1989).

There is no established program for hazardous waste disposal on Prince Edward Island (Curley, 1988). However, the Air and Solid Wastes Branch of the P.E.I. Department of the Environment cooperates with their federal counterparts in controlling toxic waste disposal. For example, asbestos, which has been removed from buildings is double-bagged and dumped at landfill sites. Agricultural pesticides are sometimes left at dumpsites illegally. Since it is difficult to regulate such practices, remnant chemicals could become a potential hazard to both surface and groundwater resources. Hazardous waste accumulation or disposal is not a problem in the watershed.

The only other major form of toxic wastes on P.E.I. are polychlorinated biphenols (PCB's). As these compounds do not break down under normal conditions they must be stored until they can be transported to a proper disposal site (located off-Island). There are not any registered PCB-user or storage sites located within the watershed (Guardian - Patriot, 1988).

7.4 Excavation Pits

Scattered throughout Prince Edward Island are numerous excavation pits used for the private and commercial removal of sandstone, and to lesser amounts, gravel and sand. A total of seven registered excavation pits (Map 11L/2) are active within the Murray River Watershed. Records are not kept concerning the quantity of material removed from the individual pits (Howard, 1989). There are probably additional smaller pits being operated for which permits have not been obtained. As well, records are not maintained concerning the number of non-operational or abandoned pits (Murphy, 1988).

7.5 Salt / Sand Storage Locations

The P.E.I. Department of Transportation and Public Works maintains a number of salt/sand storage areas across the Island. At these temporary sites, the salt and sand is stored directly on the ground with little or no site preparation. Often, the locations of these secondary sites change thereby yielding both abandoned and active sites. There is one active site in the watershed. It is located in Alliston near the headwaters of the Greek River (Map 11L/2).

7.6 Snow Disposal Sites

Since the communities located within the Murray River Watershed are of such a small size, there are no major problems with snow accumulation on streets. Snow is plowed or blown into the ditch. However, snow which accumulates in the Village of Murray River is occassionally dumped into the Murray River (White, 1989).

7.7 Additional Industrial Activities

The remainder of the industrial activities undertaken within the watershed are small manufacturing or processing businesses which have little or no effect on the quality of its surface waters.

8.0 ALTERATIONS OF NATURAL FEATURES OF WATERWAYS

Individuals or groups wishing to alter a water system directly or indirectly to improve its recreational potential,

to provide a reservoir for agricultural purposes or fire protection or to construct a stream crossing, must seek approval from the Water Resources Branch of the P.E.I. Department of the Environment (Environmental Protection Act, Sections 10 and 11).

8.1 Application Process and Requirements

Alteration applications are subject to government control under the P.E.I. Environmental Protection Act (Section 10) and the Canada Fisheries Act (Chapter F-14, Section 20). Before requests are given final approval by the Head of the Watercourse Alteration Advisory Committee, they are reviewed by several Federal/Provincial Government and private agencies. Once approval is granted, inspections are carried out to ensure that the recommendations of the Committee are being followed.

Application considerations include the following criteria: the well-being of the fisheries resource; possible changes in water quality; stream-side cutting leading to loss of essential food and cover for wildlife; and the effects of the alteration on other types of wildlife.

Types of alterations include; installation of dams and/or fishways, bypass pond construction, roadway culvert installation, rock gabion installation and the infilling of marshes. Infilling applications, most often, are rejected since the practice results in a loss of wildlife habitat.

Since P.E.I. soils are highly susceptible to erosion, proponents who alter waterways must undertake erosion control measures throughout the construction process.

8.2 Dam Inspections

There are eight dams located within the Murray River Watershed (Map 11L/2) all of which were inspected during the project. Two of the dams were found to constitute a total barrier to fish passage. The reasons for this were due either to the design of the dams, breakdown of the structures, the presence of debris within the waterways or insufficient water flows. Other dams were breached (washed out) while others presented a partial barrier to fish passage.

8.3 Fishways

On Prince Edward Island, whenever an alteration is made to a waterway, the continued passage of fish must be ensured [Canada Fisheries Act, Chapter F-14, Section 20, (1)]. This involves, in some cases, the construction of a fishway. Various fishway designs are available with the type constructed dependent upon the species of fish to be passed and the water level fluctuations within the impoundment.

Two fishways are located within the Murray River Watershed. The two step wooden pool and weir fishway located at MacLures Pond in Murray River has been dismantled while improvements are made to the pond. It will be reconstructed once work is completed to the pond. Finlaysons Pond, a Ducks Unlimited Canada site on the Greek River, also has a pool and weir fishway.

8.4 Road - Stream Intersections

The P.E.I. Department of Transportation and Public Works maintains a reference map which provides an up-to-date record of all major highway structures, that is, those over 1.2 metres in diameter, within the province. The Murray River Watershed contains thirty-six (36) such crossings (Map 11L/2).

The Watershed Inventory Project also identified twenty-eight (28) additional road - stream intersections for which records are not kept on file at the Department of Transportation and Public Works (Map 11L/2). These areas were located via 1:50,000 N.T.S. maps but not all have been field checked due to time and manpower constraints.

8.5 Rail - Stream Intersections

Rail transportation on Prince Edward Island is losing out to higher costs and the more efficient method of trucking goods across the Island. As a result of this phenomenon, all rail lines across the province were abandoned effective January 1990.

The watershed contains five rail - stream crossings (Map 11L/2). Regular inspections and maintenance of the crossings will be discontinued after abandonment. This may lead to future problems for fish passage since, in most cases, only the ties and rails are removed.

9.0 WETLANDS

Wetlands include salt marshes, intertidal flats, bogs, freshwater marshes, swamps and ponds. They are important for many reasons (Canadian Wildlife Service, n.d.):

1. as wildlife habitat;
2. act as natural filters;
3. bind pollutants thereby slowing the eutrophication process;
4. reduce flooding by acting as reservoirs; and
5. recharge the groundwater supplies.

During 1983 - 84 wetlands over 0.25 hectares on Prince Edward Island were inventoried. The objective of the Program

was to provide information on the classification, size, distribution and wildlife value of P.E.I. wetlands.

9.1 Freshwater Wetlands

All freshwater wetlands within Prince Edward Island were identified during the Inventory and were given a wildlife value based on a wide array of parameters. The wetlands received a score between 36 and 108 with a score of 60+ indicating generally more productive areas.

There were a total of eighteen (18) freshwater wetlands with a score of 60+ delineated within the Murray River Watershed (Map 11L/2), (Canadian Wildlife Service, n.d.).

9.2 Coastal Wetlands

Coastal wetlands were classified and scored as coastal units during the inventory. The coastal unit score was calculated using the total of the scores from six component types of wetlands along with five additional factors. Also added to that was a value for the disturbance status of the unit. The total coastal unit score indicated its productivity and provided a measure of its importance to wildlife. The coastal unit scores ranged from 10 to 1500 points and were indicated as the sum of all wetlands within the unit.

There are three wetlands which are classified as coastal units located within the Murray River Watershed (Map 11L/2), (Canadian Wildlife Service, n.d.).

9.3 Ducks Unlimited Canada Management Sites

Ducks Unlimited Canada (D.U.) is active on Prince Edward Island in the enhancement and management of wildlife habitat. Several types of management techniques are employed for this purpose. Installation of water control devices such as drop inlets and stoplog control structures allow for the creation of ponds and the regulation of water levels in order to maintain optimal habitat conditions. Fishways are usually installed with the water level control structures in order to allow for the continued passage of fish into and out of the impoundment.

Ducks Unlimited is involved with two projects in the Murray River Watershed. They are located at Finlaysons Pond and MacLures (Stricklands) Pond (Map 11L/2). MacLures Pond is a seventy-one (71) hectare site located in Murray River. Completed in 1981 and undergoing additional improvments in 1988-89, this project offers overwintering habitat for waterfowl such as goldeneyes and mergansers and increased habitat for furbearing animals and trout. Finlaysons Pond is a ten and a half (10.5) hectare site which was completed in 1986. It offers habitat for waterfowl, furbearing animals

and fish.

10.0 ADDITIONAL ACTIVITIES WITHIN THE MURRAY RIVER WATERSHED

10.1 Hydrometric Stations / Water Chemistry Data

The first streamflow data collected in Prince Edward Island was from the Dunk River at Rogers Mill between 1919 and 1935. Currently, there are two stations on P.E.I. which have been in operation since 1961. There are not any hydrometric stations located within the Murray River Watershed.

In addition, the Water Quality Branch, Inland Waters Directorate, Environment Canada, Moncton, New Brunswick also maintains somewhat limited data associated with the following studies:

- P.E.I. Groundwater Study (May 1972 - September 1973);
- P.E.I. Surface Water Quality Survey (July 1972);
- Water Quality Board National Water Quality Monitoring (April 1974 - March 1978); and the
- Toxic Chemical Survey (1985).

Parameters monitored included the following: major ions, physical parameters, nutrients, metals and toxic substances.

10.2 Murray River Pines Natural Area

Since much of P.E.I. has been influenced and changed by man's activities, there has been an increasing effort towards protecting the remaining natural areas on the Island. There are seven categories of natural areas, namely; woodlands, offshore islands, bogs, salt marshes, natural ponds, riparian zones and sand-dune communities.

In the early 1980's the International Biological Programme, a co-operative undertaking of almost one hundred countries interested in, among other things, identifying natural areas, led the University of Prince Edward Island's Biology Department to identify thirty-nine (39) candidate natural areas across the province.

Murray River Pines Natural Area occupies an area of four hectares on the east side of MacLures Pond. This particular site was chosen because the woodlands contain one of the province's best examples of old growth pine (red and white) forest with some of the trees dating back to the pre - 1870's. Attractions of the area include a hiking trail and several species of wildlife.

11.0 ACTIVITIES AFFECTING SURFACE WATER RESOURCES WITHIN THE MURRAY RIVER WATERSHED

Many of the problems affecting surface water resources within the Murray River Watershed occur as a result of the high erodibility of Island soils. Soil erosion is accelerated by poor agricultural, forestry and road maintenance and construction practices. The problems affecting surface water resources on P.E.I. can be placed into three general categories: sedimentation (siltation) sources, pollution point sources and instream obstructions.

11.1 Sedimentation (Siltation) Sources

The entry of soil into surface waterways is described by the Watershed Inventory Project as a sedimentation (siltation) source. Autumn tillage, particularly plowing with the slope and cultivation excessively close to the streams' edge, often results in extensive landwash and siltation of the Island's waterways. Improper forestry operations, such as clearcutting on steep slopes and removal of greenbelts also provides for sedimentation of streams and rivers.

One of the major sources of siltation to Island waterways is caused by the construction and maintenance of P.E.I. roads. Many roads on the Island are unpaved which presents numerous potential sources of sedimentation. Improper grading of these roads, in particular, leaving a ridge of clay and sand at either edge allows runoff water to form channels causing erosion to the road surface. Water usually flows alongside these ridges until it "breaks" through, usually at a road-stream intersection. This practice of grading also renders ditches, if present, useless.

Silt-loading of Island streams and rivers does not usually affect the waterway at the point of entry but its effects are impacted further downstream. Soil particles are carried by currents and eventually deposited onto the streambed covering essential finfish spawning areas. Shellfish beds in the estuaries are also smothered by silt that has originated from upstream locations.

11.1.1 Glenwilliam

There is extensive roadside erosion occurring at this road-stream intersection, located upstream of MacDonalds Pond, on the Murray River (Map 11L/2). The road is very sandy and does not have a ditch which provides for poor drainage. As a result, there is channelling occurring at the road's edge with the runoff eventually entering waterways.

11.1.2 Fox River

A development resulting in the construction of three cottages on the shore of the Fox River (Map 11L/2) has resulted in sedimentation to the River.

11.1.3 Mink River Pond

Siltation is occurring to the pond and to a section of the outlet channel as all vegetation has been removed (Map 11L/2).

11.2 Pollution Point Sources

The entry of non-natural substances into a surface waterway is known as a pollution point source. For example, fertilizer and manure runoff into surface waterways results in bacterial and chemical contamination of the system. Inadequately or improperly treated human sewage, stormwater drainage and the discharge of industrial effluents also contribute to the deterioration of P.E.I.'s surface water quality.

The most recent examples of pollution point sources on the Island have been the entry of petroleum products, specifically gasoline, into streams, rivers and groundwater aquifers. This has resulted from either transportation accidents or leakage from underground storage tanks.

In many cases, the result of these pollution point sources is the eutrophication of the aquatic system. As is the case with siltation, the effects of many pollution point sources are felt in downstream areas. This can, for example, result in the closure of shellfish harvesting areas.

11.2.1 Milmot

A section of the Fox River, located downstream of Jordans Pond (Map 11L/2), is used by cattle as a watering site. This constitutes both a pollution point source and sedimentation source to the Fox River.

11.2.2 Murray River I

Many homes and business located along the banks of the Murray River discharge untreated sewage directly into the River thereby constituting a pollution point source.

11.2.3 Murray River II

Several stormwater drainage inlets in the Village of Murray River exit directly into the Murray River. The runoff is not treated prior to being discharged except that there

are sand traps in some of the catch basins which function in filtering large materials therby preventing them from entering the waterway (MacKay, 1989).

11.3 Instream Obstructions

Numerous other factors also influence the quality of the surface waterways within the watershed. Fallen trees or other debris in the streams and rivers present problems for fish passage. Improperly installed and unmaintained culverts, insufficient water flow and inadequate or non-existent dam bypass structures not only pose barriers to successful fish passage but also affect the amount of water available for use in downstream areas by other proponents.

11.3.1 Mink River

This road-stream intersection, which is located on the Mink River (Map 11L/2), constitutes a complete barrier to fish passage. The 1.30 metre steel arched culvert with a wooden floor has less than 0.02 metres of water flowing through it. The upstream section of the stream is choked with vegetation, mainly cattails, resulting in decreased water depth.

11.3.2 Indian Creek

This 1.30 metre steel arched culvert road-stream crossing at Indian Creek (Map 11L/2) does not pass water and therefore, fish during periods of low flow.

11.3.3 Greek River

A 0.75 metre steel culvert, located on the road crossing an unnamed tributary of the Greek River (Map 11L/2), does not pass fish during low tide.

11.3.4 MacDonalds Pond

The outlet from this pond, located in the upper reaches of the Murray River (Map 11L/2), is steep (greater than 2.50 metres) and strewn with rocks thereby constituting a complete barrier to fish passage.

11.3.5 Dump Road Pond

A woods road traversing a bypass channel of an unnamed pond, located downstream of Jordans Pond on the Fox River (Map 11L/2), has been partially breached. Debris is collecting in the breached channel thereby creating a partial barrier to fish passage. Fish may be able to navigate the channel during periods of high water.

11.3.6 Jordans Pond

A large barrier containing Jordans Pond, which is located on the Fox River (Map 11L/2), creates a complete barrier to fish passage.

11.3.7 Mink River Pond

There are two barriers on this pond, which is located on the Mink River (Map 11L/2), constituting a complete blockage to fish passage. The first barrier is a road crossing the stream (dirt and debris pushed into the stream) without a culvert to allow for water flow. The second barrier, the largest of the two, is a highly banked road - stream crossing also lacking in a culvert.

REFERENCES

Aitken, A., Department of Fisheries and Oceans, Charlottetown, written comm., 1989.

Canada Land Inventory, Soil Capability For Agriculture, 1968.

Canadian Wildlife Service, Wetlands Atlas of Prince Edward Island, n.d.

Clough, K., P.E.I. Department of Agriculture, Charlottetown, pers. comm., 1988.

Curley, K., Air and Solid Wastes Branch, P.E.I. Department of the Environment, Charlottetown, pers. comm., 1989.

Curley, K., Air and Solid Wastes Branch, P.E.I. Department of Community and Cultural Affairs, Charlottetown, pers. comm., 1988.

Dibblee, R., Biologist, Fish and Wildlife Branch, P.E.I. Department of the Environment, Charlottetown, pers. comm., 1989.

Fraser, S., Provincial Camp Commissioner, Girl Guides of Canada, Montague, P.E.I., 1989.

The Guardian - Patriot, September 1, 1988.

Horne, F., S. Knudson, A. Rice and C. Roumbanis, 1988 Scenic Heritage Roads Program - Final Report, Island Nature Trust, Charlottetown, 1988.

Howard, B., Director, Environmental Management Branch, P.E.I. Department of the Environment, Charlottetown, pers. comm., 1989.

MacKay, I., District Supervisor, 4th Kings, P.E.I. Department of Transportation and Public Works, Murray River, pers. comm., 1989.

MacKinnon, S., Fisheries Officer, Department of Fisheries and Oceans, Souris, P.E.I., pers. comm., 1989.

MacLean, S., Director of Water Safety, Canadian Red Cross Society, Charlottetown, pers. comm., 1989.

MacLure, G., Construction Engineer, P.E.I. Department of Transportation and Public Works, Charlottetown, pers. comm., 1989.

Mills, D., Parks Service, P.E.I. Department of Tourism and Parks, Charlottetown, pers. comm., 1989.

Murphy, C., Environmental Management Branch, P.E.I. Department of Community and Cultural Affairs, Charlottetown, 1988.

Murphy, L., Department of Fisheries and Oceans, Charlottetown, written comm., 1989.

Murphy, S., P.E.I. Department of Agriculture, Charlottetown, pers. comm., 1988.

P.E.I. Department of Tourism and Parks, Angling on Prince Edward Island, 1988.

P.E.I. Department of Tourism and Parks, Canoeing in Prince Edward Island, n.d.

Pharo, C., Agriculture Canada, Charlottetown, pers. comm., 1989.

Small, D., Department of Fisheries and Oceans, Ellerslie, P.E.I., pers. comm., 1988.

Stewart, W., Conservation Officer, Fish and Wildlife Branch, P.E.I. Department of the Environment, Montague, pers. comm., 1989.

Taylor, K., Inland Waters Directorate, Environment Canada, Dartmouth, N.S., pers. comm., 1988.

Walker, P., General Director, Atlantic Pioneer Camp, Point Pleasant, P.E.I., pers. comm., 1989.

Water Resources Branch, P.E.I. Department of Community and Cultural Affairs, Prince Edward Island Active and Abandoned Waste Disposal Site Survey - Phase I, Charlottetown, 1983.

White, D, Municipal Administrator for Murray River, P.E.I., pers. comm., 1989.

Younie, C., Agricultural Representative, P.E.I. Department of Agriculture, Montague, P.E.I., pers. comm., 1989.

APPENDIX

MURRAY RIVER WATERSHED DAM INSPECTIONS

NAME	UTM LOCATION

McLure's Pond 529400-5095100

No barrier as there is 0.30 meters of water in culvert.

Upper McLure's Pond 525900-5097300

Bypass Pond does not constitute a barrier. This is the site of a new finfish aquaculture facility.

MacDonald's Pond 527100-5098700

Complete barrier as fish must overcome a 2.50 meter high barrier to get to the pond level. The channel is very rocky with little water flowing through it.

Dump Road Pond 532400-5094200

A road traversing a bypass channel has been partially breached. Debris has been collecting in the channel thereby creating a partial barrier to fish passage at this bypass pond.

Jordan's Pond 533000-5094600

Large pond (upstream) barrier creates a complete obstruction to fish passage beyond this point.

Unnamed Pond 534400-5100200

Bypass pond with channel does not present any problems for fish passage.

Mink River Pond 537100-5101700

Two barriers. The first is a road crossing the stream gravel and dirt pushed into stream - no culvert. The second is 5.0 meters upstream of the first barrier. It is a highly banked road crossing the channel without any culverts to allow for fish passage thus creating a complete barrier to fish.

Greek River Tributary 531600-5097900

No dam was found. The dam is probably breached.